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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT APPLICATION

INVENTORS: Boland, Richard Robert
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CASE: Lucent Technologies Inc. Case No. Boland 6-17-1

TITLE: Apparatus, Method And System For Intelligent Tandeming Of Incoming Calls To Application Nodes In Telecommunication Systems

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Enclosed are the following papers relating to the above-named application for patent:

Specification, claims and abstract (23 pages)
4 informal sheets of drawings
1 Assignment with Cover Sheet
Declaration and Power of Attorney

CLAIMS AS FILED:

The fee has been calculated as shown below:

				Small Entity			Large Entity	
FOR	No. Filed	No. Allowed	No. Extra	Rate	Fee	OR	Rate	Fee
Basic Fee					$345.00	OR		$690.00
Total Claims	37	- 20 =	17	x $9.00	$	OR	x $18.00	$306.00
Independent Claims	3	- 3 =	0	x $39.00	$	OR	x $78.00	$
Multiple Dep. Claims				+ $130.00	$	OR	+ $260.00	$
Other Fees				$	$	OR	$	$
				TOTAL	$	OR	TOTAL	$996.00

Please file the application and charge Lucent Technologies, Inc. Deposit Account No. 12-2325 the amount of $996.00 to cover the filing fee. Duplicate copies of this letter are enclosed. In the event of non-payment or improper payment of required fee, the Commissioner is authorized to charge or to credit Deposit Account No. 12-2325 as required to correct the error.

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APPARATUS, METHOD AND SYSTEM FOR INTELLIGENT TANDEMING OF INCOMING CALLS TO APPLICATION NODES IN TELECOMMUNICATION SYSTEMS

Cross-Reference to a Related Application

This application is related to Boland et al., U. S. Patent Application Serial No. _____, entitled "Apparatus, Method And System For Message-Based Intelligent Tandeming Of Incoming Calls To Application Nodes In Telecommunication Systems", filed concurrently herewith and commonly assigned to Lucent Technologies, Inc., and incorporated by reference herein, with priority claimed for all commonly disclosed subject matter (the "related application").

Field of the Invention

The present invention relates in general to wireless and wireline telecommunication systems, and more particularly, to an apparatus, method and system for intelligent tandeming of incoming calls to application nodes in telecommunication systems.

Background of the Invention

With the advent of increasingly sophisticated telecommunication services, various systems have been created which allow "tandeming" of an incoming call leg to an application node. Such tandeming is utilized to implement various advanced services, especially in mobile or other wireless environments, such as calling party pays services, prepaid services, and one number services. For calling party pays services, an application node generates billing and other information, for telecommunication services to be billed to the calling (or "A") party, rather than being billed to the called party. For prepaid services, the subscriber (called or "B" party) has prepaid for particular types of services, such as having paid in advance for an amount of communication time for wireless communication services. For one number services, the application typically sequentially

alerts various telephones of the subscriber, such as first alerting a home (wireline) telephone, and if unanswered, sequentially alerting a mobile telephone, followed by alerting a paging device.

To provide such services, an incoming call leg for a subscriber directory number (as a called party directory number) is typically tandemed by a network switch to an application node within the telecommunications network. In such tandeming, a call leg which is incoming to a network switch on a predetermined trunk group is routed to an application node, rather than directly delivered to the subscriber. Following performance of the particular application, such as determining that the subscriber has sufficiently prepaid his or her account to support another incoming call, the incoming call leg is then routed back to the network switch, for subsequent delivery or routing to the subscriber.

In the prior art, such tandeming is performed both on a group basis and on an all-or-none basis. For example, for certain groups of subscribers, typically designated by trunk groups, incoming call legs are automatically tandemed to an application node, while for other groups of subscribers, also typically designated by trunk groups, incoming call legs are never tandemed, with all incoming call legs always directly routed to the subscriber.

In addition, in the prior art, if the tandeming is unsuccessful, no provision is made for call delivery to or other services for the subscriber. Instead, the prior art systems typically provide only a reorder (fast busy) announcement to the calling party, who must then redial the call. Such lack of call delivery unnecessarily uses network resources, and unnecessarily loses potential revenue for these undelivered, tandemed calls.

As a consequence, a need remains to provide for intelligent tandeming, where incoming calls may be tandemed or not tandemed to an application node on an individual basis, rather than a group basis. Such tandeming should also provide for default call delivery to the subscriber, to avoid unnecessary use of network resources and to avoid a potential loss of revenue. Such tandeming should also be cost effective, capable of implementation in existing telecommunication systems, and should be user friendly and user transparent. In addition, such tandeming should be dynamic and

responsive to changing environmental and user conditions which may arise in wireless or wireline communication systems.

Summary of the Invention

An apparatus, method and system are provided for intelligent tandeming of an incoming call to an application node in telecommunication systems. The various embodiments utilize a new parameter, referred to as a tandem parameter, to designate whether incoming calls to a particular subscriber are to be tandemed to an application node or are to be delivered directly to the subscriber.

In the preferred embodiment, the tandem parameter is included as a predesignated value of a field within an ANSI-compatible calling features indicator parameter, and may be utilized within a plurality of ANSI-compatible messages, including a registration notification return result, a qualification request return result, a location request return result, and a qualification directive (invoke).

The preferred system embodiment includes an adjunct network entity, a database, and a switching center. The adjunct network entity, such as a service circuit node or service control point, has one or more application nodes or platforms, supporting various telecommunication services such as prepaid services, calling party pays services, and one number services. The database, such as a home location register or visitor location register, stores information such as subscriber profiles, and includes storing the tandem parameter.

The switching center, such as a mobile switching center, is configured to receive an incoming call leg directed to a called party directory number and to obtain a subscriber profile from the database, and when the subscriber profile does not include a tandem parameter, to route the incoming call leg to the called party directory number. The switching center is further configured, when the subscriber profile includes the tandem parameter, to obtain a routing parameter and perform digit analysis of the called party directory number. When the digit analysis has been performed successfully, the switching center is further configured to tandem the incoming call leg to the application node, and when the digit analysis has not been performed successfully, to provide a default mode for the incoming call leg. In the preferred embodiment, the default mode

includes routing the incoming call leg to the called party directory number or providing an announcement to the calling party.

For backwards or retro-compatibility, in the preferred system embodiment, the switching center is further configured, when the subscriber profile does not include the tandem parameter, to determine whether a trunk group of the incoming call leg is predesignated for tandeming. The switching center is further configured, when the subscriber profile does not include the tandem parameter but when the trunk group of the incoming call leg is predesignated for tandeming, to tandem the incoming call leg to the application node. The switching center is also further configured, when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is not predesignated for tandeming, to route the incoming call leg to the called party directory number.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a block diagram illustrating a system embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention.

Fig. 2 is a block diagram illustrating, in greater detail, application nodes of a system embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention.

Fig. 3 is a block diagram illustrating an apparatus embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention.

Fig. 4 is a flow diagram illustrating a method embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention.

Detailed Description of the Invention

While the present invention is susceptible of embodiment in many different forms, there are shown in the drawings and will be described herein in detail specific embodiments thereof, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

As mentioned above, a need remains to provide for intelligent tandeming, where incoming calls may be tandemed or not tandemed to an application node on an individual basis, rather than a group basis. Such intelligent tandeming is provided in accordance with the present invention. The various embodiments of the present invention also provide for default call delivery to the subscriber, to avoid unnecessary use of network resources and to avoid a potential loss of revenue. The intelligent tandeming of the present invention is cost effective, capable of implementation in existing telecommunication systems, and is user friendly and user transparent. In addition, such intelligent tandeming is dynamic and responsive to changing environmental and user conditions which may arise in wireless or wireline communication systems.

Fig. 1 is a block diagram illustrating a system embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention. The system 100 includes one or more mobile switching centers ("MSCs") 115 and one or more wireline switching centers 105 (collectively "switching centers"), which may also be connected via trunk and signaling lines to each other and to a broader network 110, such as to a public switched telephone network ("PSTN"), with multiple telecommunication connections to other locations, such as providing a link to a satellite 135, which may be one or more communications or global positioning system satellites, and providing a link to gateway 160, such as for international communication or packet-based communication. The system 100 may also have a network (such as internet) connection to one or more computers 155 (or other network communication device).

The system 100 may also include one or more intelligent network devices referred to as adjunct network entities 120, such as a home location register ("HLR"), a visitor location register ("VLR"), another type of database, a service control point

("SCP"), a service circuit node ("SCN") (also referred to as a service node), an intelligent peripheral ("IP"), or another intelligent network device. One or more adjunct network entities 120 are preferably connected or coupled to a wireline switching center 105 and to a MSC 115. In the preferred embodiment, the adjunct network entities 120 provide a node or platform for particular applications, referred to herein as "application nodes" 125, such as a voice mail application, a calling party pays application, a prepaid application, a one number service application, and other intelligent network applications.

The wireline switching center 105 is also generally connected to a plurality of telephones 140 or other customer premise equipment, while the MSCs 115 (via base stations 145 or other wireless transceivers) typically have a wireless link to the various mobile units 130, such as cellular telephones, within a particular geographic region, for voice and data communication. In addition, while the wireline and mobile switching centers 105 and 115 are usually physically separated due to regulatory and other historical reasons, these switching centers may also be combined into one or more switching centers having both wireline and wireless functionalities.

Fig. 2 is a block diagram illustrating, in greater detail, the application nodes 125 of a system embodiment 200 in accordance with the present invention. The system 200 also includes one or more switching centers, which are preferably mobile switching centers (MSCs) 115, but also within the scope of the invention may be wireline switching centers 105. The various switching centers 115 and 105 may also be connected via trunk and signaling lines to each other and also to a broader network 110. For ease of explanation, various application nodes running on one or more adjunct network entities 120 are separately illustrated in Fig. 2, such as a voice mail application node 125A, a calling party pays ("CPP") application node 125B, a prepaid service ("PPD") application node 125C, a one number service ("ONS") application node 125D, and a database application node 125E (collectively referred to as application nodes 125); it should be understood, however, that such application nodes 125 are applications or platforms running or operating within adjunct network entities 120, such as within SCPs and SCNs. Also as illustrated in Fig. 2, a particular type of database, a home location register ("HLR") 150, is separately illustrated as a stand-alone HLR 150; in other embodiments, such HLR functionality may be integrated into any of the switching centers 115 or 105

(as an integrated home location register ("I-HLR")). As illustrated, the various switching centers 115 or 105, respectively, have a wireless link to the various mobile units 130, such as cellular telephones (via base stations 145 or other wireless transceivers), or may be coupled to a plurality of telephones 140 or other customer premise equipment.

Continuing to refer to Fig. 2, an incoming call leg may be received at or by one of the switching centers 115 or 105. Prior to routing or delivering the incoming call leg to a called party or to an application node 125, in accordance with the present invention, two factors are examined by the switching center 115 or 105. First, typically by accessing the HLR 150 or other database 125E, the switching center 115 or 105 determines a subscriber profile of the called party, typically correlated to the subscriber directory number ("DN") or the subscriber mobile unit 130 identification number, as discussed in greater detail below and in the related application. The subscriber profile typically includes various parameters designating the type of service to be received by a subscriber (or the subscriber's particular mobile unit 130) and other telecommunication features provided to the subscriber (or the subscriber's particular mobile unit 130). As discussed in greater detail below, in accordance with the present invention, a new parameter, referred to herein as a tandem parameter, may be included within the subscriber profile.

Based upon the parameters included in the subscriber profile of the called party, the incoming call leg may or may not be tandemed to one of the application nodes 125. Second, the switching center 115 or 105 also determines whether the trunk group of the incoming call leg indicates that the incoming call leg should be tandemed to an application node 125. When neither the subscriber profile nor the trunk group of the incoming call leg indicates that the incoming call leg should be tandemed to an application node 125, the switching center 115 or 105 routes or delivers the call leg to the called party (such as to the subscriber's mobile unit 130).

When either the subscriber profile or the trunk group of the incoming call leg indicates that the incoming call leg should be tandemed to an application node 125, the switching center 115 or 105 obtains routing parameters, such as dialing classes, rate centers, routing classes, and origination indicators, which determine, among other things, the outgoing trunk group for routing the call and the appropriate application node 125 for

tandeming. The switching center 115 or 105 then performs digit analysis of the called party DN, which is also used for routing. The digit analysis of the called party directory number determines a pattern match for available trunk groups for outgoing routing or tandeming of the incoming call leg and determines a format for the outgoing routing or tandeming of the incoming call leg (such as ISUP, DTMF or R2 signaling).

If this digit analysis is successful, then the call leg is routed to an appropriate application node 125 (as indicated by either the subscriber profile, the incoming trunk group or the routing parameters). Following such routing to an application node 125 and performance of the appropriate functions by the application node 125, the call leg is returned to the switching center 115 or 105 by the application node. The call leg returned to the switching center 115 or 105 is generally on a trunk group which does not provide for tandeming and which specifically bypasses any further tandeming or tandeming analysis, or includes appropriate messaging indicating no further tandeming of the call leg (such as a predetermined value of the tandeming parameter). The call leg is then routed by the switching center 115 or 105 to the called party, such as to a mobile unit 130. If this digit analysis for routing to an application node 125 is unsuccessful, in accordance with the present invention, a default mode is provided, in which the call leg is delivered (routed) to the called party (such as to the subscriber's mobile unit 130), or in which an announcement is played to the calling party.

For example, from the network 110, an incoming call leg may be received by a switching center 115 for a mobile unit 130 (subscriber or called party) directory number. The switching center 115 determines, from either the trunk group of the incoming call leg or the subscriber profile (of the particular mobile unit 130), whether to tandem the incoming call leg to an indicated application node 125, or whether to directly deliver the incoming call leg to the particular mobile unit 130. For example, if the subscriber profile indicates that the particular mobile unit 130 has prepaid service, the switching center 115 will obtain corresponding routing parameters, perform digit analysis to obtain routing data, followed by routing (outpulsing) the incoming call leg to the prepaid application node 125C. Following its determinations, such as credit determinations, assuming sufficient credit, the prepaid application node 125C will route the call leg back to the switching center 115, and will do so on a return trunk group which

is not designated for tandeming. The switching center 115 then delivers the call to the mobile unit 130.

Of particular significance for the present invention, and as disclosed in greater detail in the related application, is the use of a new parameter, referred to as a tandem parameter, in a subscriber profile, to designate appropriate tandeming of incoming calls for the subscriber (as the called party, via a mobile unit 130 or telephone 140). (In the related application, the tandem parameter is also referred to as a "call time" parameter for legacy systems, with a new value of the call time parameter utilized to indicate tandeming). This new tandem parameter, in the preferred embodiment, is stored in a database such as an HLR150, and for roaming conditions, may also be stored in a VLR of the corresponding (originating) switching center 115. With use of the new tandem parameter, incoming call legs may be tandemed on an individual, rather than a group (trunk group) basis, in accordance with the present invention.

In addition, to respond to changing environmental and subscriber needs, a subscriber profile may be dynamically modified, as needed, to include or exclude the new tandem parameter, or to change the value of the new tandem parameter, for any particular service or feature which involves tandeming to an application node 125. This may be done through use of a central database (such as an HLR 150) to, for example, change a subscriber's profile (such as by excluding a tandem parameter for prepaid service or by changing the value of the new tandem parameter for prepaid service), in order to change a subscriber's service from prepaid to another payment plan, and eliminate the corresponding need for tandeming. Corresponding values of the new tandem parameter may be utilized to designate the use or non-use of other service features which involve tandeming to an application node 125.

Such use of a central database for services and features for a subscriber also provides greater flexibility and ease of use for service providers. The service provider may regularly and simply update or revise the new tandem parameter in such a central database, as needed, to add or remove services or telecommunication features requiring tandeming for any given subscriber.

Another advantage of the use of the new tandem parameter is that in order to change a subscriber's type of service, no trunk groups or directory numbers are

required to be changed. Rather, a subscriber may retain the same DN, while nonetheless changing his or her service from a tandeming mode to a direct delivery mode, all through changes in database records.

Another advantage to the intelligent tandeming of the present invention is its user transparency and user friendliness. For a service provider, intelligent tandeming decisions may be implemented through a parameter in a central database. For a subscriber, the intelligent tandeming decisions occur transparently, within the background of call routing.

Yet another advantage of the present invention is the elimination of the prior art circuitous routing requirements for tandeming applications. Typically, in the prior art, an incoming call to a mobile unit 130 in its home region was not subject to tandeming; rather, all incoming call legs to a home mobile unit 130 would be directly routed to that mobile unit 130. In order to implement services (such as prepaid service) in the prior art, incoming call legs for such a mobile unit 130 would be forced to a non-home switching center 115, for routing to an application node 125, followed by subsequent routing to the home switching center 115 for call delivery. Such prior art methodology unnecessarily uses additional network resources, such as additional trunk lines between switching centers 115 or 105.

In addition, the present invention also provides a default mode, to avoid a loss or disruption of service, and corresponding loss of potential revenue to the service provider. In the prior art, if digit analysis (for routing to an application node 125) were unsuccessful, the call would not be completed, the calling party typically received a reorder message (a fast busy signal), and any potential revenue for that particular call would be lost. In accordance with the present invention, however, in the event that digit analysis for tandeming is unsuccessful, the tandeming is bypassed, with a default mode providing for actual call delivery.

Another significant feature of the present invention is its backwards compatibility. Rather than relying solely on the use of the tandem parameter, the present invention also examines the trunk group of the incoming call leg, to allow for tandeming in older, legacy systems.

As discussed in greater detail in the related application, the new tandem parameter used in a subscriber profile is preferably implemented to be compatible with the ANSI-41 standard for mobile communication promulgated by the American National Standards Institute. In the preferred embodiment, the new tandem parameter is added to the variable length "calling features indicator" parameter used, among other places, in ANSI-41 messages such as a registration notification return result, a qualification request return result, and a qualification directive (invoke). In the preferred embodiment, the tandem parameter is also used within an ANSI-41 compatible location request return result message, transmitted from a HLR 150 to a switching center 115.

Use of the new tandem parameter in these various ANSI-41 messages, in accordance with the present invention and the invention of the related application, allows for intelligent tandeming regardless of where the mobile unit 130 may be located, such as regardless of whether the mobile unit 130 is in its home region or is roaming in a visited region. By including or excluding such a parameter within a subscriber profile maintained in a central database (such as HLR 150), that information is available to a home switching center 115 and to a non-home switching center 115 (through inclusion of the parameter in various messages, for storage and access in the corresponding VLR). For example, as a mobile unit 130 enters or powers up in a non-home, visited region, the switching center 115 of the visited region may transmit a registration notification message to the HLR 150 of the home region and, in turn, will receive a registration notification return result message containing information pertaining to the subscriber profile, including the new tandem parameter, which is then stored in a VLR of the switching center 115 of the visited region. For incoming calls to or from the roaming mobile unit 130, the VLR is accessed by the switching center of the visited region, with intelligent tandeming decisions made accordingly, based upon the new tandem parameter.

Fig. 3 is a block diagram illustrating an apparatus embodiment 300 to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention. Such an apparatus 300 preferably may be included within a switching center 115 or 105, or distributed among a switching center 115 or 105 and an adjunct network entity 120 of a system 100 or 200. The apparatus 300 includes a processor 310, a network interface 315, and a

memory 320. The network interface 315 is utilized to receive and transmit data, such as voice information, control messages, and other pertinent information, and may be utilized to receive incoming call legs and transmit outgoing call legs (for either tandeming or direct delivery to the subscriber). The memory 320 may be an integrated circuit (such as various forms of RAM), a magnetic hard drive, an optical storage device, or any other type of data storage apparatus. The memory 320 is used to store information pertaining to program instructions or configurations (discussed below), call management and other call information, such as subscriber profile information. The memory 320 performs such information storage, and may be included within a database (such as database 125E), or within an HLR or VLR, which may be stand-alone (such as HLR 150) or integrated (I-HLR) within a switching center 115 or 105, or may be included as other platforms within adjunct network entities 120.

Continuing to refer to Fig. 3, the processor 310 may include a single integrated circuit ("IC"), or may include a plurality of integrated circuits or other components connected, arranged or grouped together, such as microprocessors, digital signal processors ("DSPs"), custom ICs, application specific integrated circuits ("ASICs"), field programmable gate arrays ("FPGAs"), associated memory (such as RAM and ROM), and other ICs and components. As a consequence, as used herein, the term processor should be understood to equivalently mean and include a single IC, or arrangement of custom ICs, ASICs, processors, microprocessors, controllers, FPGAs, or some other grouping of integrated circuits which perform the functions discussed above with reference to Figs. 1 and 2, and also discussed in detail below with reference to Fig. 4, with associated memory, such as microprocessor memory or additional RAM, DRAM, SRAM, MRAM, ROM, EPROM or E^2PROM. The processor 310 with its associated memory may be configured (via programming or hard-wiring) to perform the methodology of the invention, as discussed above with reference to Figs. 1-2 and as discussed below with reference to Fig. 4. For example, the methodology may be programmed and stored, in the processor 310 with its associated memory (and/or memory 320) and other equivalent components, as a set of program instructions (or equivalent configuration or other program) for subsequent execution when the processor 310 is operative (*i.e.,* powered on and functioning). Equivalently, when the processor 310 with

its associated memory and other equivalent components are implemented in whole or part as FPGAs, custom ICs and/or ASICs, the FPGAs, custom ICs or ASICs also may be designed, configured and/or hard-wired to implement the methodology of the invention. In the preferred embodiment, the processor 310 is implemented in its entirety as a microprocessor, which is programmed to implement the methodology of the invention.

As mentioned above, in addition to incorporation within a switching center 115 (or 105), such an apparatus 200 may be distributed among a switching center 115 or 105 and an adjunct network entity 120. For example, the apparatus 300 may be distributed among an MSC 115 and an adjunct network entity 120, with the memory 320 incorporated within the adjunct network entity 120 (such as an HLR 150 or other database 125E), with the processor 310 having components within either or both the MSC 115 and the adjunct network entity 120, and with the network interface 215 incorporated within the MSC 115. Numerous other variations and equivalent embodiments will be readily apparent are also within the scope of the present invention.

Fig. 4 is a flow diagram illustrating a method embodiment to provide for intelligent tandeming of incoming calls to application nodes in telecommunication systems in accordance with the present invention, and provides a useful summary of the present invention. The method begins, step 400, with reception of an incoming call leg at a network switch, such as at a switching center 115 or 105. The switching center 115 or 105 then determines a subscriber profile (preferably corresponding to the called party DN), typically by accessing a database such as an HLR 150, step 405. The switching center 115 or 105 then examines the subscriber profile, to determine whether incoming calls are to be tandemed, such as whether the subscriber profile includes a tandem parameter, step 410. When the subscriber profile does not indicate that incoming calls to the subscriber's DN are to be tandemed in step 410, the method determines whether the trunk group of the incoming call leg is predesignated for tandeming, step 415. When the subscriber profile does not indicate that incoming calls to the subscriber's DN are to be tandemed in step 410, and when the trunk group of the incoming call leg is not predesignated for tandeming in step 415, the switching center 115 or 105 routes or delivers the call to the subscriber (via a mobile unit 130 or telephone 140), step 445.

When the subscriber profile does indicate that incoming calls to the subscriber's DN are to be tandemed in step 410, or when the trunk group of the incoming call leg is predesignated for tandeming in step 415, the switching center 115 or 105 obtains routing parameters for the incoming call to the subscriber's DN, step 420. The switching center 115 or 105 then performs digit analysis of the subscriber's (called party's) directory number, step 425. When the digit analysis is successful, step 430, the switching center 115 or 105 routes (outpulses) the call to an appropriate application node 125, step 435. When the digit analysis for tandeming is unsuccessful in step 430, the method proceeds to a default mode, proceeding to step 440.

For a default mode, a service provider may prefer to deliver the call directly to the subscriber, or may prefer an option to play an announcement to the calling party. As a consequence, following an unsuccessful digit analysis for tandeming in step 430, the method proceeds to step 440, to determine whether an announcement should be played to the calling party. When an announcement is not to be played to the calling party in step 440, the switching center 115 or 105 routes or delivers the call to the subscriber (via a mobile unit 130 or telephone 140), step 445. When an announcement is to be played to the calling party in step 440, the switching center 115 or 105 provides for playing such an announcement, step 450. Following steps 435, 445 or 450, the method may end, return step 455.

Numerous advantages of the present invention may be apparent from the above discussion. The various embodiments of the present invention provide for intelligent tandeming, where incoming calls may be tandemed or not tandemed to an application node on an individual basis, rather than a group basis. The various embodiments include the use of a new tandem parameter, to designate appropriate tandeming in a subscriber profile, on an individual and modifiable basis.

The various embodiments also provide for default call delivery to the subscriber, to avoid unnecessary use of network resources and to avoid a potential loss of revenue. The intelligent tandeming of the present invention is cost effective, capable of implementation in existing telecommunication systems, and is user friendly and user transparent. In addition, such intelligent tandeming is dynamic and responsive to

changing environmental and user conditions which may arise in wireless or wireline communication systems.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the novel concept of the invention. It is to be understood that no limitation with respect to the specific methods and apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

It is claimed:

1. A method for intelligent tandeming of an incoming call to an application node in telecommunication systems, the method comprising:

(a) receiving an incoming call leg directed to a called party directory number;

(b) determining a subscriber profile;

(c) when the subscriber profile does not include a tandem parameter, routing the incoming call leg to the called party directory number;

(d) when the subscriber profile includes the tandem parameter, obtaining a routing parameter and performing digit analysis of the called party directory number;

(e) when the digit analysis has been performed successfully, tandeming the incoming call leg to the application node; and

(f) when the digit analysis has not been performed successfully, providing a default mode for the incoming call leg.

2. The method of claim 1, wherein step (c) further comprises:

when the subscriber profile does not include the tandem parameter, determining whether a trunk group of the incoming call leg is predesignated for tandeming;

when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is predesignated for tandeming, tandeming the incoming call leg to the application node; and

when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is not predesignated for tandeming, routing the incoming call leg to the called party directory number.

3. The method of claim 1, wherein the default mode comprises routing the incoming call leg to the called party directory number.

4. The method of claim 1, wherein the default mode comprises providing for an announcement to be played to a calling party of the incoming call leg.

5. The method of claim 1, wherein the tandem parameter is a predesignated value of a field in the subscriber profile.

6. The method of claim 1, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible calling features indicator parameter.

7. The method of claim 1, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible message of a plurality of ANSI-compatible messages, the plurality of ANSI-compatible messages including a registration notification return result, a qualification request return result, a location request return result, and a qualification directive (invoke).

8. The method of claim 1, wherein the routing parameter is selected from a plurality of routing parameters, the plurality of routing parameters including a plurality of dialing classes, a plurality of rate centers, a plurality of routing classes, and a plurality of origination indicators.

9. The method of claim 1, wherein the routing parameter determines a selection of a trunk group for outgoing routing or tandeming of the incoming call leg.

10. The method of claim 1, wherein the digit analysis of the called party directory number determines a pattern match for available trunk groups for outgoing routing or tandeming of the incoming call leg and determines a format for the outgoing routing or tandeming of the incoming call leg.

11. An apparatus for intelligent tandeming of an incoming call to an application node in telecommunication systems, the apparatus comprising:

a network interface for reception of an incoming call leg directed to a called party directory number;

a memory; and

a processor coupled to the network interface and to the memory, wherein the processor, when operative, is configured to determine a subscriber profile, and when the subscriber profile does not include a tandem parameter, to route the incoming call leg to the called party directory number; the processor further configured, when the subscriber profile includes the tandem parameter, to obtain a routing parameter and perform digit analysis of the called party directory number; and the processor further configured, when the digit analysis has been performed successfully, to tandem the incoming call leg to the application node, and when the digit analysis has not been performed successfully, to provide a default mode for the incoming call leg.

12. The apparatus of claim 11, wherein the processor is further configured, when the subscriber profile does not include the tandem parameter, to determine whether a trunk group of the incoming call leg is predesignated for tandeming; the processor further configured, when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is predesignated for tandeming, to tandem the incoming call leg to the application node; and the processor further configured, when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is not predesignated for tandeming, to route the incoming call leg to the called party directory number.

13. The apparatus of claim 11, wherein the default mode comprises routing the incoming call leg to the called party directory number.

14. The apparatus of claim 11, wherein the default mode comprises providing for an announcement to be played to a calling party of the incoming call leg.

15. The apparatus of claim 11, wherein the tandem parameter is a predesignated value of a field in the subscriber profile.

16. The apparatus of claim 11, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible calling features indicator parameter.

17. The apparatus of claim 11, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible message of a plurality of ANSI-compatible messages, the plurality of ANSI-compatible messages including a registration notification return result, a qualification request return result, a location request return result, and a qualification directive (invoke).

18. The apparatus of claim 11, wherein the routing parameter is selected from a plurality of routing parameters, the plurality of routing parameters including a plurality of dialing classes, a plurality of rate centers, a plurality of routing classes, and a plurality of origination indicators.

19. The apparatus of claim 11, wherein the processor is further configured, based upon the routing parameter, to select of a trunk group for outgoing routing or tandeming of the incoming call leg.

20. The apparatus of claim 11, wherein the processor is further configured, based upon digit analysis of the called party directory number, to determine a pattern match for available trunk groups for outgoing routing or tandeming of the incoming call leg and to determine a format for the outgoing routing or tandeming of the incoming call leg.

21. A system for intelligent tandeming of an incoming call to an application node in telecommunication systems, the system comprising:

an adjunct network entity, the adjunct network entity having the application node;

a database; and

a switching center couplable to the adjunct network entity and to the database, wherein the switching center, when operative, is configured to receive an incoming call leg directed to a called party directory number and to obtain a subscriber profile from the database, and when the subscriber profile does not include a tandem parameter, to route the incoming call leg to the called party directory number; the switching center further configured, when the subscriber profile includes the tandem parameter, to obtain a routing parameter and perform digit analysis of the called party directory number; and the switching center further configured, when the digit analysis has been performed successfully, to tandem the incoming call leg to the application node, and when the digit analysis has not been performed successfully, to provide a default mode for the incoming call leg.

22. The system of claim 21, wherein the switching center is further configured, when the subscriber profile does not include the tandem parameter, to determine whether a trunk group of the incoming call leg is predesignated for tandeming; the switching center further configured, when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is predesignated for tandeming, to tandem the incoming call leg to the application node; and the switching center further configured, when the subscriber profile does not include the tandem parameter and when the trunk group of the incoming call leg is not predesignated for tandeming, to route the incoming call leg to the called party directory number.

23. The system of claim 21, wherein the default mode comprises routing the incoming call leg to the called party directory number.

24. The system of claim 21, wherein the default mode comprises providing for an announcement to be played to a calling party of the incoming call leg.

25. The system of claim 21, wherein the tandem parameter is a predesignated value of a field in the subscriber profile.

26. The system of claim 21, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible calling features indicator parameter.

27. The system of claim 21, wherein the tandem parameter is included as a predesignated value of a field within an ANSI-compatible message of a plurality of ANSI-compatible messages, the plurality of ANSI-compatible messages including a registration notification return result, a qualification request return result, a location request return result, and a qualification directive (invoke).

28. The system of claim 21, wherein the routing parameter is selected from a plurality of routing parameters, the plurality of routing parameters including a plurality of dialing classes, a plurality of rate centers, a plurality of routing classes, and a plurality of origination indicators.

29. The system of claim 21, wherein the switching center is further configured, based upon the routing parameter, to select of a trunk group for outgoing routing or tandeming of the incoming call leg.

30. The system of claim 21, wherein the switching center is further configured, based upon digit analysis of the called party directory number, to determine a pattern match for available trunk groups for outgoing routing or tandeming of the incoming call leg and to determine a format for the outgoing routing or tandeming of the incoming call leg.

31. The system of claim 21, wherein the database is a home location register.

32. The system of claim 21, wherein the database is a visitor location register.

33. The system of claim 21, wherein the switching center is a mobile switching center.

34. The system of claim 21, wherein the switching center is a wireline switching center.

35. The system of claim 21, wherein the application node is a prepaid telecommunication service.

36. The system of claim 21, wherein the application node is a calling party pays telecommunication service.

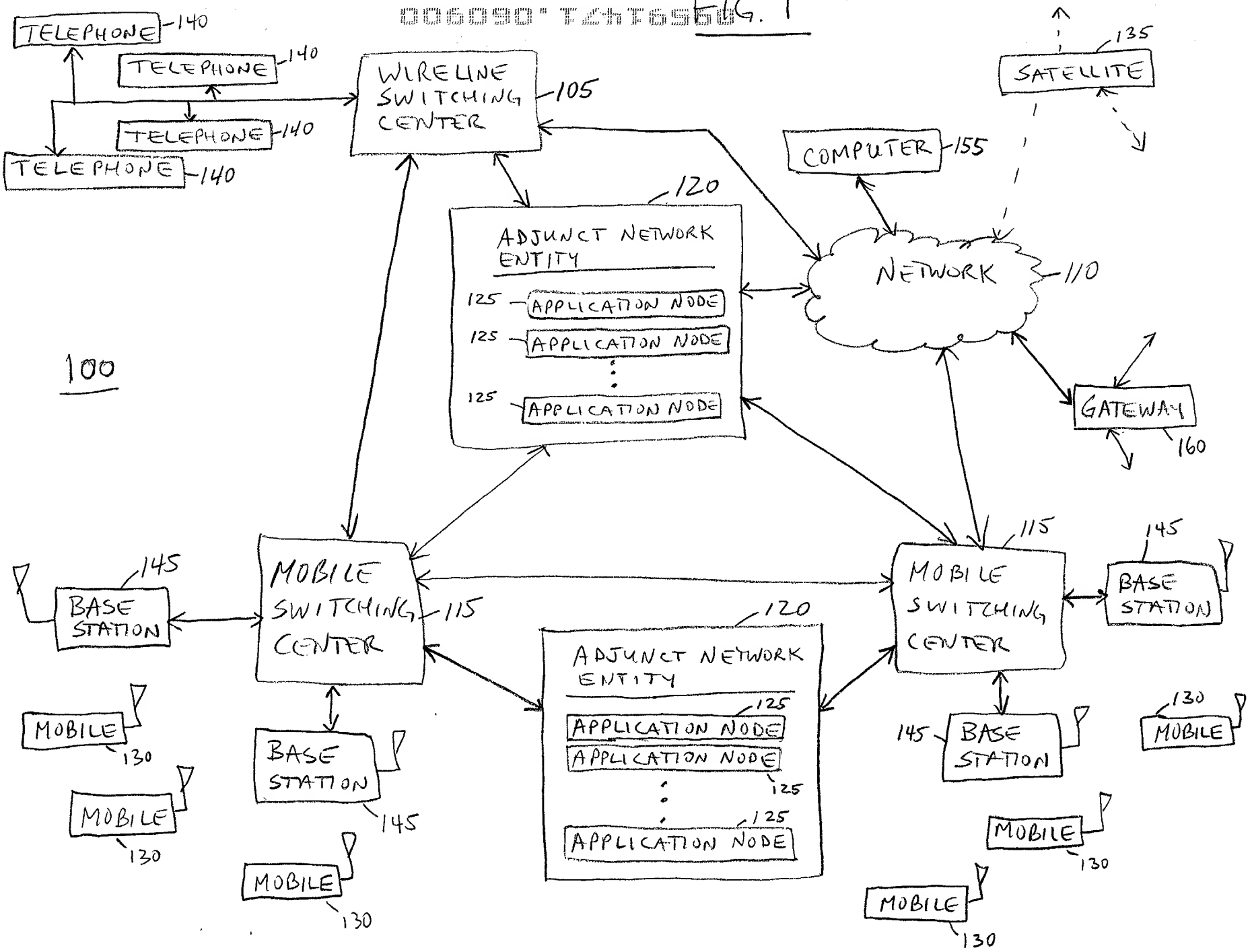
37. The system of claim 21, wherein the application node is a one number telecommunication service.

APPARATUS, METHOD AND SYSTEM FOR INTELLIGENT TANDEMING OF INCOMING CALLS TO APPLICATION NODES IN TELECOMMUNICATION SYSTEMS

Abstract of the Disclosure

An apparatus, method and system are provided for intelligent tandeming of an incoming call to an application node in telecommunication systems. The various embodiments utilize a new parameter, referred to as a tandem parameter, to designate whether incoming calls to a particular subscriber are to be tandemed to an application node or are to be delivered directly to the subscriber. The preferred system embodiment includes an adjunct network entity, a database, and a switching center. The adjunct network entity, such as a service circuit node or service control point, has one or more application nodes or platforms, supporting various telecommunication services such as prepaid services, calling party pays services, and one number services. The database, such as a home location register or visitor location register, stores information such as subscriber profiles, and includes storing the tandem parameter. The switching center, such as a mobile switching center, is configured to receive an incoming call leg directed to a called party directory number and to obtain a subscriber profile from the database, and when the subscriber profile does not include a tandem parameter, to route the incoming call leg to the called party directory number. When the subscriber profile includes the tandem parameter, the switching center obtains a routing parameter and performs digit analysis of the called party directory number. When the digit analysis has been performed successfully, the switching center tandems the incoming call leg to the application node, and when the digit analysis has not been performed successfully, provides a default mode for the incoming call leg. In the preferred embodiment, the default mode includes routing the incoming call leg to the called party directory number or providing an announcement to the calling party.

FIG. 1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TELEPHONE
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TELEPHONE
140
TELEPHONE
140
WIRELINE SWITCHING CENTER
105
SATELLITE
135
COMPUTER
155
120
ADJUNCT NETWORK ENTITY
125
APPLICATION NODE
125
APPLICATION NODE
125
APPLICATION NODE
NETWORK
110
100
GATEWAY
160
145
BASE STATION
MOBILE SWITCHING CENTER
115
MOBILE SWITCHING CENTER
115
145
BASE STATION
120
ADJUNCT NETWORK ENTITY
125
APPLICATION NODE
APPLICATION NODE
125
125
APPLICATION NODE
MOBILE
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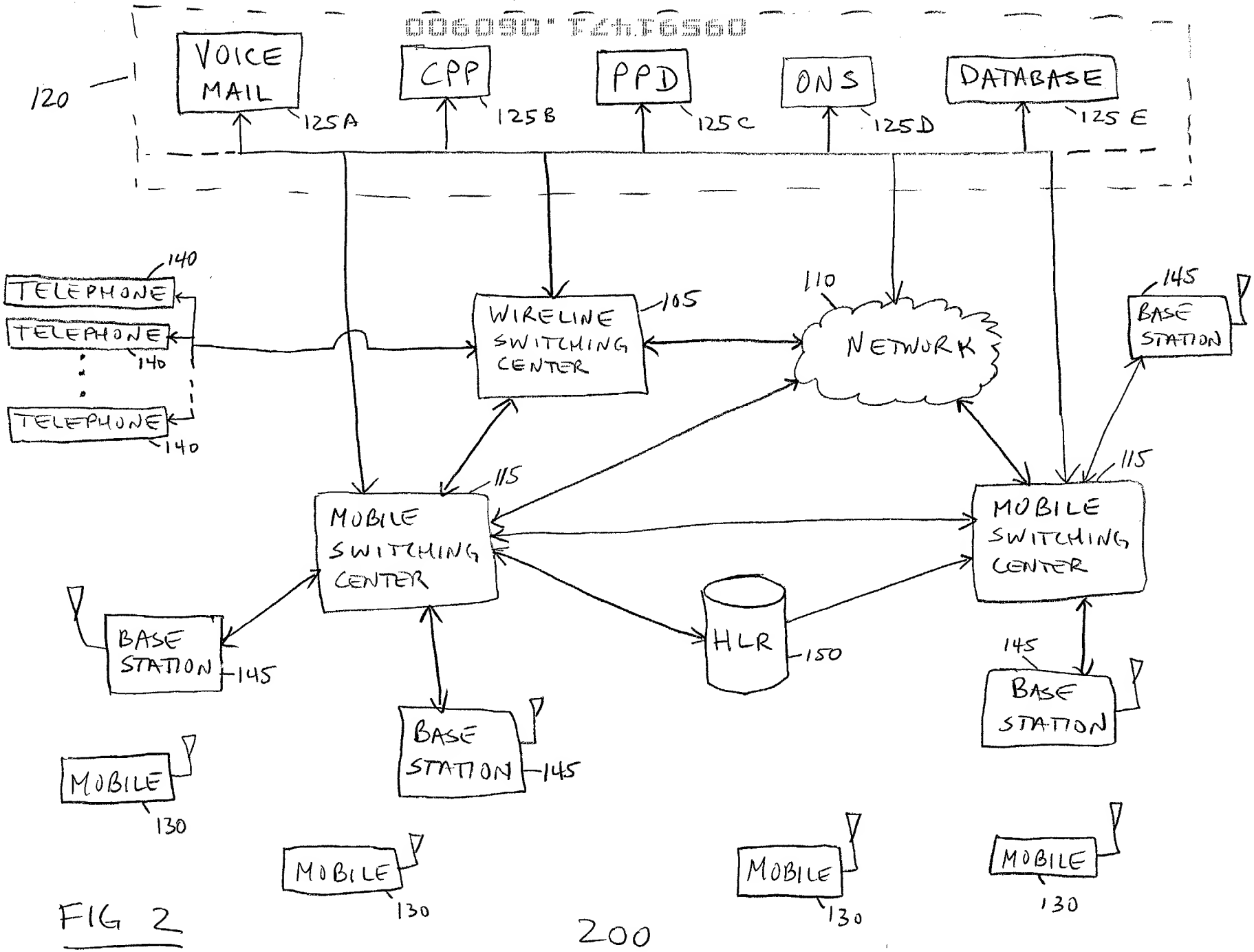
130
MOBILE
130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VOICE MAIL
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CPP
125B
PPD
125C
ONS
125D
DATABASE
125E
TELEPHONE
140
TELEPHONE
140
TELEPHONE
140
WIRELINE SWITCHING CENTER
105
110
NETWORK
BASE STATION
145
MOBILE SWITCHING CENTER
115
MOBILE SWITCHING CENTER
115
BASE STATION
145
HLR
150
BASE STATION
145
BASE STATION
145
MOBILE
130
MOBILE
130
MOBILE
130
MOBILE
130

FIG 2

200

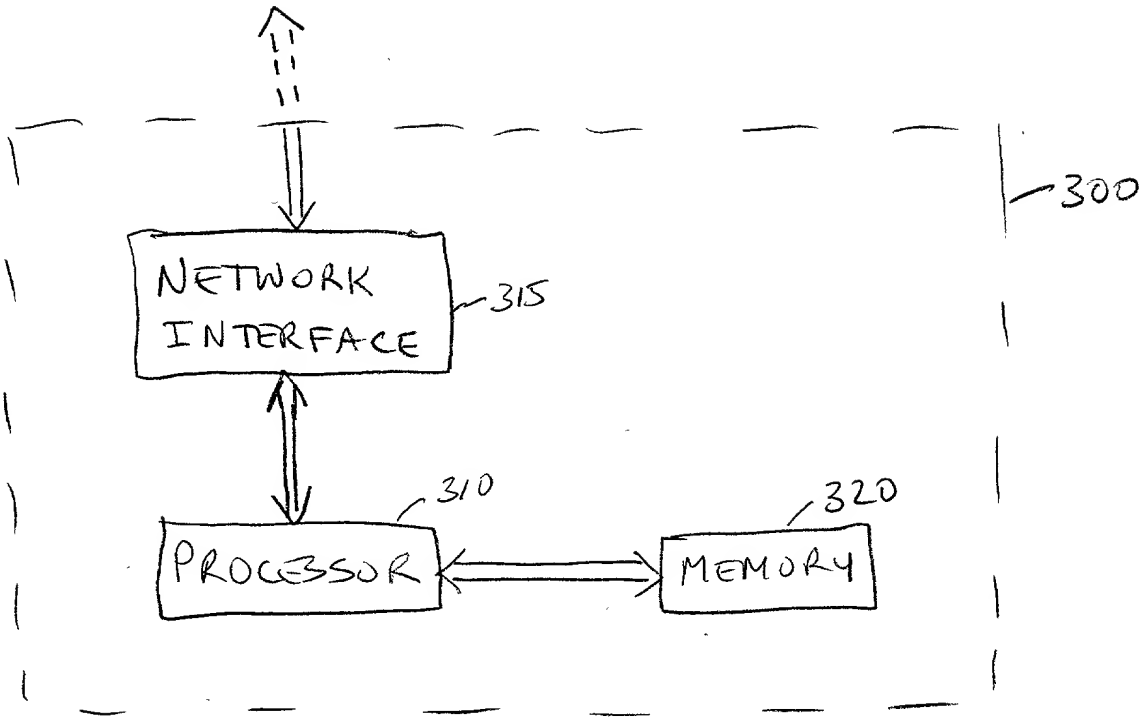
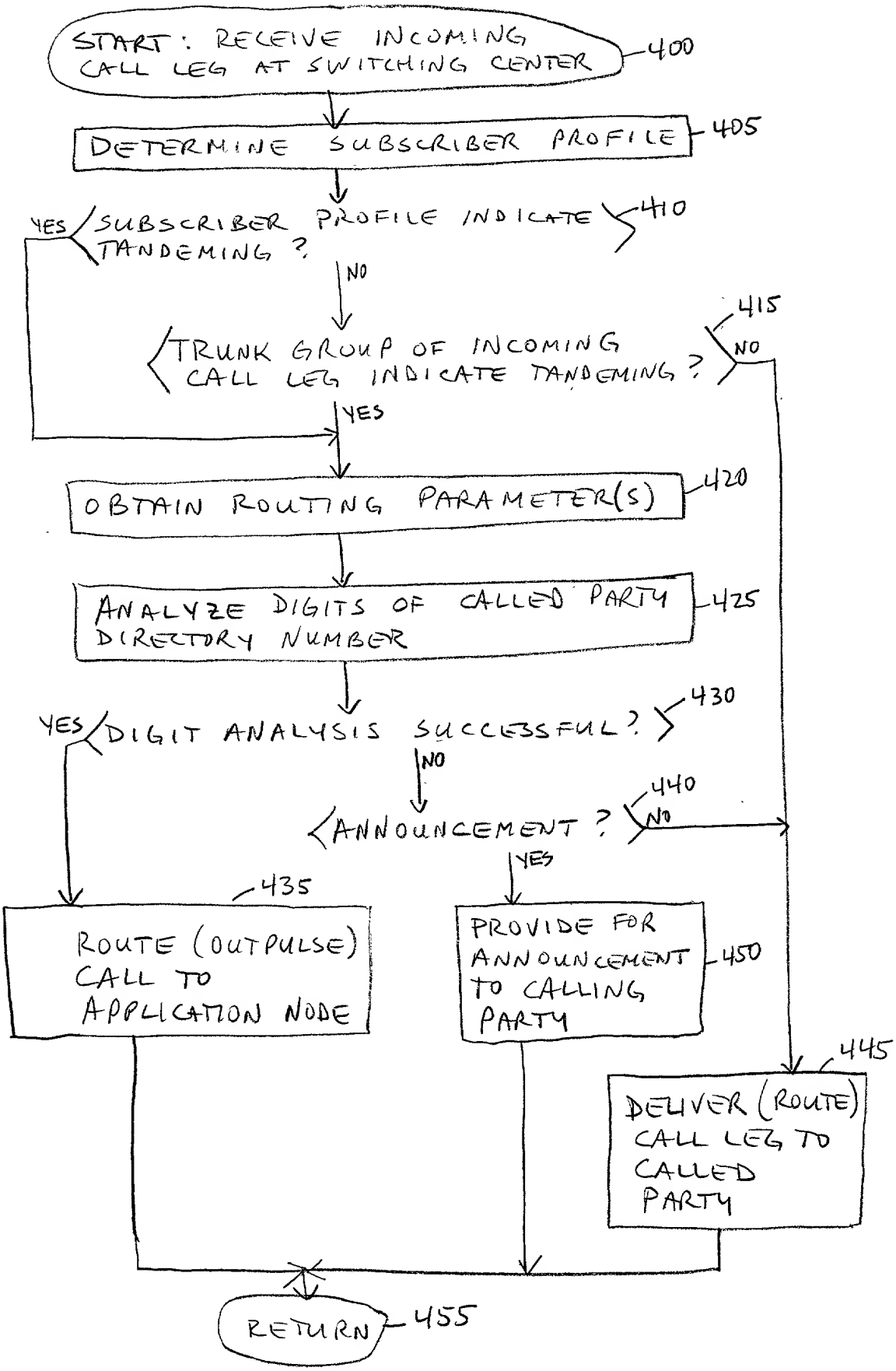


FIG. 3


START: RECEIVE INCOMING CALL LEG AT SWITCHING CENTER
400
DETERMINE SUBSCRIBER PROFILE
405
SUBSCRIBER PROFILE INDICATE TANDEMING ?
410
YES
NO
TRUNK GROUP OF INCOMING CALL LEG INDICATE TANDEMING ?
415
NO
YES
OBTAIN ROUTING PARAMETER(S)
420
ANALYZE DIGITS OF CALLED PARTY DIRECTORY NUMBER
425
DIGIT ANALYSIS SUCCESSFUL ?
430
YES
NO
ANNOUNCEMENT ?
440
NO
YES
ROUTE (OUTPULSE) CALL TO APPLICATION NODE
435
PROVIDE FOR ANNOUNCEMENT TO CALLING PARTY
450
DELIVER (ROUTE) CALL LEG TO CALLED PARTY
445
RETURN
455

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Declaration and Power of Attorney

As one of the below named inventors, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **APPARATUS, METHOD AND SYSTEM FOR INTELLIGENT TANDEMING OF INCOMING CALLS TO APPLICATION NODES IN TELECOMMUNICATION SYSTEMS** the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

Thomas J. Bean	(Reg. No. 44528)
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Anthony Grillo	(Reg. No. 36535)
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Ronald D. Slusky	(Reg. No. 26585)
David L. Smith	(Reg. No. 30592)
Ozer M. N. Teitelbaum	(Reg. No. 36698)
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Jeffrey M. Weinick	(Reg. No. 36304)
Eli Weiss	(Reg. No. 17765)

I hereby appoint the attorney on ATTACHMENT A as an associate attorney in the aforementioned application, with full power solely to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected with the prosecution of said application. No other powers are granted to such associate attorney(s) and such associate attorney(s) are specifically denied any power of substitution or revocation.

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